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Effective HSE-MS Implementation: A Success Story of Ikike Project 6 Million + Manhours with NO LTI

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Abstract

Ikike is an undeveloped field located 20km offshore and approximately 15km north of the Amenam complex in 20m water depth. The Amenam field which has been producing since July 2003 is located approximately 60km southeast of the NLNG Plant and 95km Southeast of Port Harcourt and the water depth range from 30 to 40 meters.

The Ikike project leverages on the existing Amenam facilities to keep costs low and is designed to minimize greenhouse gas emissions. Estimated at less than 4kg CO_2e/boe, they will contribute to reducing the average carbon intensity of TotalEnergies' upstream portfolio.

Given to the inherent hazard and risk associated with Oil & Gas projects from Conceptual phase to Front End Engineering Design studies, to fabrication and constructions as well as installation and commissioning, HSE management system becomes pivotal to driving an incident free project phases.

This Paper focuses on the sound application of the Project HSE Management strategy, plan and system which comprises a set of components that includes;

- Project HSE Policy and HSE objectives,
- Identification of the risk involved in the Project activities,
- An organization within which the HSE responsibilities are clearly defined,
- Competent and trained personnel,
- Internal and external communication.
- Practises and processes formally defined in the project documentation,
- Evaluation and reviews of Project HSE performances,
- Correctives action plans and periodic management reviews,
- An HSE audit program

All of these were deployed during the Ikike project towards demonstrating and providing a means of anticipating and controlling the risks involved in the Project which had continuously improved the HSE performances all through the project in conformance with project improvement goals set for the Project.

Several other proactive and reactive measures were taken towards ensuring a success story of Ikike Project with a total of 6milliom man hours of No Lost Time Incident.

Introduction

IKIKE field is located 20 km offshore off the Nigerian coast, approximately 15 km north from the Amenam Complex in 20 m of water in the OML 99 concession (JV NNPC 60% TEPNG 40%), outside of the Amenam-Kpono unitized area.

It was discovered in 1976 and comprises several distinct identified reservoirs. The Amenam field, which has been producing since July 2003, is located approximately 60 km southeast of the NLNG plant at Bonny Island, and 95 Km southeast of the Port Harcourt and water depth ranges from 30 to 40 meters.

The IKIKE field is being developed as a satellite tie-back to Amenam, making use of the spare capacity of the Amenam process facilities due to the decline of the Amenam production

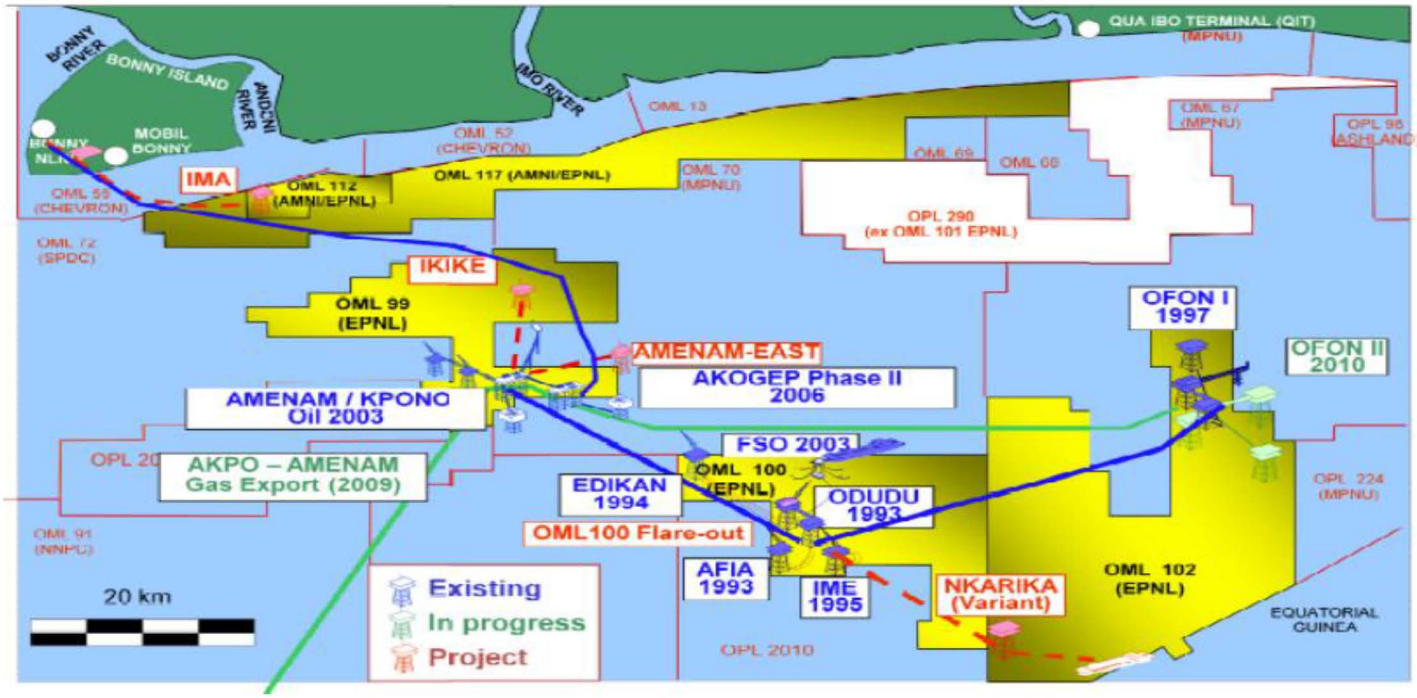

Figure – 1.0—Ikike Location

The main development of IKIKE field is based on fluid production, unmanned and minimum facilities with tie-back to existing Amenam production hub for treatment and export.

A wellhead platform will be installed at an optimized location in the IKIKE field, and the multiphase produced fluids will be routed via a 12" multiphase flowline to the AMD2 platform. The produced fluids will be processed on AMP1/AMP2.

The IKD1 wellhead platform is designed based on a "minimalist approach". The platform consists of 6 well slots (3 for production, 2 for water injection and 1 for contingency production or water injection well), a vent system, closed and open drain systems, chemical injection packages, MPFM for each flowline and a production manifold.

The fluids are exported via a 12"multiphase export riser and flowline. A pig launcher is available for pigging operations on the export lines.

This concept is a fully rated platform / pipeline with a design pressure of 340 bara.

There is no power generation on the IKD1 platform, power is supplied via a subsea power cable from the AMP2 platform.

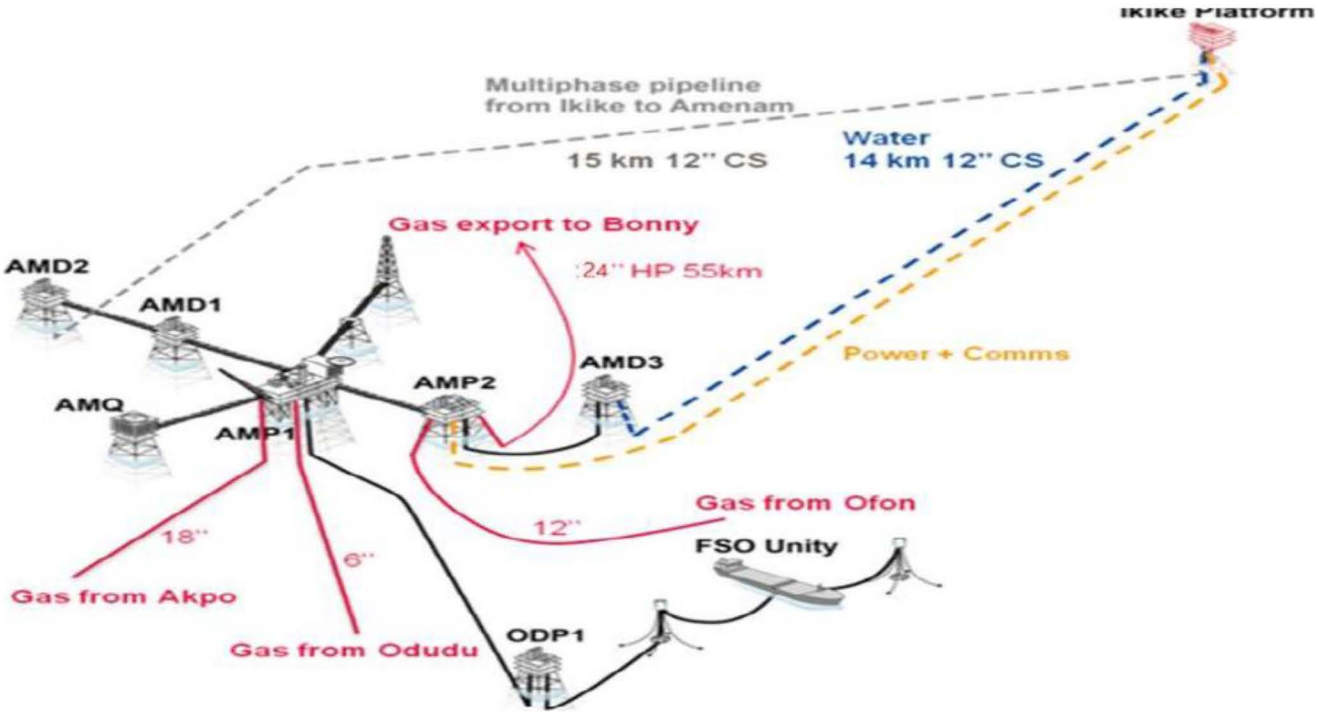

Figure – 2.0—Amenam field Overview

Ikike HSE Plan

The success story of Ikike project with 6milliom No LTI manhours began with the development of a Project HSE Plan. The Health, Safety and Environment plan for Ikike Project in compliance to the Total Upstream Companies in Nigeria HSE Policy and more specifically in adherence to the Company HSE Management System, by implementing the MAESTRO principles was developed at the start up of the project studies and validated by stakeholders.

This plan describes in detail the HSE requirements to be applied during the different phases of the project; Drilling, Construction, Installation, Hook-up, Commissioning and Start-up phases of the Project (i.e. up to the full hand-over of the installation to Field Operations) and is based on the Company HSE general documentation, and specific Safety and Environment analysis performed during the course of the Project. The HSE Management Process for the offshore installation, hook-up, commissioning and start-up phases / activities was however reviewed in more detail in a subsequent revision of the HSE Plan. This led to the definition of the project HSE framework and objectives as;

- Develop and pursue, through all stages in the life-cycle of the installation, a systematic approach to risk reduction.
- Co-ordinate health/safety objectives and respect for the environment taking into account economic constraints.
- Include all activities within the general Sustainable Development Objectives of the Company.

To ensure that the requirements are fully met, all hazards associated with the design and future operation of the field and all associated facilities were systematically identified and evaluated through dedicated

Hazard Identification process, as well as other related risk reduction measures. The general goal is to reduce residual risks to a level that is as low as reasonably practicable regarding (in order of precedence):

- The protection of human life.
- The environmental and societal impacts.
- The safeguarding of the assets

A major hazard identification and review takes place in four stages:

1. Identify the major hazards, estimate the event frequencies, define the accident scenarios and evaluate their consequences.
2. Assess the potential impact of the hazards on installations, the personnel running installations and the environment.
3. Confirm that the impacts of all the major hazards are within acceptable limits or make design/ procedural change recommendations which will bring those impacts within acceptable limits.
4. Ensure the prevention and mitigation features proposed in the overall safety design of the installations reduce risk to an ALARP level

The HAZID review covered the process and utility facilities of the new IKD1 wellhead platform, and included all risers/pipelines/cables arriving on and departing from IKD1

A Hazard Operability (HAZOP) study was carried out as a formalised method of investigating the safety of the design of a platform process with respect to deviations from its normal mode of operation. The objective of the study is to detect latent faults or hazardous interactions and identify areas where improvements to safety and operability are necessary.

The Phase 1 HAZOP review included the process and utility facilities of the IKD1 wellhead platform, including the risers and pipelines.

Apart from the HAZID and HAZOP that was extensively carried out to ensure that all possible risk at different phases of the project are identified with a corresponding risk mitigation measures, several other safety studies were carried out for the project

During the construction and installation/commissioning phase

- Prepare specific risk assessments for complex operations
- Implement systematic JRA with Contractors
- Ensure a good level of daily tool box meetings
- Unusual and complex operations: a pre-job meeting is held with the Contractor to check that all actions have been closed and all recommended safety precautions are in place prior starting the work

SIMOPS and COMOPS operations

This requires special preparation and a risk analysis by all parties involved in the operation

- Preparation of SIMOPS/COMOPS Dossier including matrix of responsibilities and a detailed schedule is mandatory
- Preparation of SIMOPS/COMOPS dossier based on a risk analysis and validated by the project authorities (in accordance with a project procedure, which formally addresses these points), the operating entity and the affiliate management

Organization, Roles and Responsibilities

HSE Responsibilities and Project Organization chart for both the company and contractor was developed to show who is doing what and taking up roles and responsibility with a clear chain of command covering project and site, HSE and construction.

The company RSES is responsible for Safety and Environment on SITE. He coordinates the various activities on SITE, with the assistance of Delegates (RSES-D). The RSES is the only person to have the leadership and responsibilities over all activities when the simultaneous operations on project was executed

- Manages the coordination between COMPANY and CONTRACTOR and ensures that interfaces and risks generated by simultaneous activities are properly mitigated.
- Verifies compliance with rules, regulations, risk control policies and procedures in force.
- Follows up on working condition of the safety devices of vessels and shall be informed by the Vessel Master of any downgraded situation.
- Defines the priorities and decides on additional risk mitigation measures as required by simultaneous operations or an unusual situation.
- Co-ordinates with the Vessel Masters during site emergency response and rescue operations in case of an emergency or accident within the SITE.
- Liaises directly with RSES-D located on the nearby installations in case of emergency.

The project manager has the overall responsibility of HSE issues related to the project.
The project HSE organization is defined according to the following principles:

- The organization structure, size and location are adapted to the breakdown of the project (packages)
- Each role is defined clearly with explicit functional links within the HSE organization and operational links with the project teams
- The HSE team works cross-functionally during projects, interacting directly with the management, technical and operational teams as well as with the affiliate

Communication Systems and Methods

An effective communication as an important tool for the successful HSE management system for Ikike project was deployed. Effective communication had ensured the objectives, performance requirements and responsibilities are clearly understood at different levels of the project. This was implemented through:

- Dissemination of CONTRACTOR HSE policy to all personnel, and instructions on its implementation;
- Distribution of HSE Handbooks, alerts and advices
- Promoting open communication between management and work force on safety matters
- Ensuring health, safety and environmental issues are included on the agenda at management meetings;
- Promoting hygiene, health and safety awareness by disseminating information such as accidents and injury statistics, and articles which have a direct impact upon the health, hygiene and safety of the workforce, sharing HSE experience and best practices;
- Management visits to work site

Competence and training

As part of the success story of the Ikike project, the competencies and training required of personnel was defined for all project positions. A training matrix covering all personnel working on the project is established for this purpose. This matrix shows which compulsory training courses each person has completed and is used to schedule the missing courses.

The specific HSE training objectives for the Project staff and workforce are:

- To provide them adequate knowledge on Project HSE procedures, precautions and accident prevention measures required during the course of their work.
- To provide them adequate information on the nature and type of work, the related hazards and the equipment and machinery to be employed in the work execution.
- To provide them information on required actions to be taken during emergency situations.
- Each group leader will take responsibility in reporting any HSE related issue on site to (site supervisor / Site Safety Officers) and it will be addressed during toolbox meeting
- To minimize environmental impacts on people and surrounding environment due to work activities and to ensure that immediate and effective remedial actions are taken

Contractor HSE Management

One of the vital requirements for the selection of contractor is based on its ability to manage the risks inherent to its activity on the work to perform and to respect the corresponding company HSE requirements. Relevant HSE requirements were specified to contractor and the HSE procedures to be developed during the execution of the subcontracted portion of work. HSE Plan containing the operating and equipment standards to be applied for the project scope of work is critically reviewed.

Orientation of contractors and Visitors

HSE orientation and onboarding program was developed for all contractors personnel and visitors before beginning work or visiting the project location and operational areas. Orientation areas include the following:

- Overview of the Project
- HSE Philosophy and Policy
- Alcohol, Drug, Substance, Fire Arms & Weapons Policies
- No Cell Phone use Policy
- Security Policies
- Anomaly Reporting
- Access Control
- No Photograph Policy
- Employee HSE responsibilities
- Facility layout including restricted areas and areas where special hazards may exist
- TEPNG 12 Golden Rules
- Awareness level training
- Emergency Preparedness and response procedures, drills and mustering

- Hazard identification, reporting and management
- Personal Protective Equipment requirement
- Safety Meeting system
- Permit to Work system
- Authority to stop work
- IKIKE Safety Culture Program – Goal Zero Incident (GZI)

Risk Assessment

Risk Management is an iintegral part of the Project and was incorporated in every phase of the Project.

The hazards to which people, the environment and assets will be exposed were systematically identified, the associated risks evaluated, and the measures, which make it possible to reduce their probability and effects were defined and implemented.

It is line management's responsibility to ensure that this critical and continuous Project activity is performed and that agreed risk reduction measures are communicated to those responsible and to the workforce for implementation.

One of the primary goals of the HSE Management Process is to ensure that the risks to personnel, the environment and to the field assets can be demonstrated to be As Low As Reasonably Practicable (ALARP). In order to meet this goal, assessment of HSE risks was continuously undertaken throughout the design process and was followed through with reviews and maintained throughout the project life

For all project scope to be executed, a Job Risk Assessment is prepared by the contractor Project & HSE Managers and shared with the company Project HSE Manager.

Task specific risks both onshore and offshore are assessed in a qualitative way as part of the Permit-to-Work system or by Job Risk Analysis (JRA)

A review within the project HSE team is done, then followed by a combine review involving the contractor, company project team and with the site management team on the project location (Amenam)

For Downgraded Situations, such as simultaneous operations (SIMOPS), specific risk reduction measures was put in place after suitable hazard identification and risk assessment, as described above. From this, a SIMOPS matrix was developed, which was carried forward into the operating phase of the Ikike installation.

Another key aspect of the Hazard Assessment process is the formal design review process. Internal Project Reviews conducted by the Company, including the Project Technical Review (PTR) program, significantly add to the quality of the review process with respect to HSE issues.

In all cases, the objective is to systematically identify hazards, assess their associated risks and apply appropriate risk reduction measures.

Line management also has the responsibility to monitor the proper operation of the risk evaluation and management process for the activities, which are under their supervision

Permit To Work System.

The permit to work process includes the minimum HSE requirements as defined in the company rule. It is described in a procedure that specifies in particular.

Organization:

- The distribution of roles and assignment of personnel (internal or contractors) involved in this process is defined. A person cannot approve or issue a permit to work for himself.

- The accurate delimitation of zones and their interconnections is defined and each zone reports to a single permit to work issuing authority.
- Everyone with a role in the permit to work process is trained and authorised to conduct their role.
- The maximum validity period for a permit to work, the applicable types of permit (cold or hot) and the required certificates (confined space, isolation, excavation, etc.) are defined.
- The exhaustive list of work that can be covered by a simplified permit to work or that can be done without a permit to work, is established after risk analysis and is reviewed annually.

Preparation

- A permit to work is based on a risk analysis.
- For all project "high risk work", a joint visit to the work site is conducted by the approving authority and the performing authority.

Approval and acceptance

- The permit to work is approved by the approving authority and accepted by the performing authority. Any change to the terms of the permit requires re-approval and re-acceptance.

Coordination

- The number of permits to work to be issued and the risks related to simultaneous operations or co-activities are taken into account when coordinating the planned work. A list of approved permits is then communicated to the issuing authority.

Execution

- At least once a day, the start of work execution is subject to a prior issue of the permit to work by the issuing authority and its countersignature by the performing authority. For "high risk works", the permit is issued once the work site has been checked.
- At the start of work on the work site, the performing authority holds a safety talk to explain the risks and risk management measures identified in the permit to work to everyone involved.
- The permit to work and associated certificates are available on the work site, and monitoring is set up by the performing authority.
- If work is suspended (general alarm, change in the work site environment, etc.), the conditions for resuming work are subject to a risk assessment. A new permit to work is prepared if necessary.
- The terms for managing permits when there is a handover are specified

A permit to work is based on a risk analysis.

Particular attention was paid to the Permit-to-Work (PTW) system and other supporting procedures. Key supporting procedures considered are:

- Management of simultaneous operations (SIMOPS)
- Job Risk Analysis for non-routine operations (intended to support work permits)
- Management of shift and rotational hand-over
- Lock out Tag out (LOTO) Procedure
- Appropriate control of the use of temporary equipment

The following key notes for effective PTW management. All PTW are based on a risk analysis.

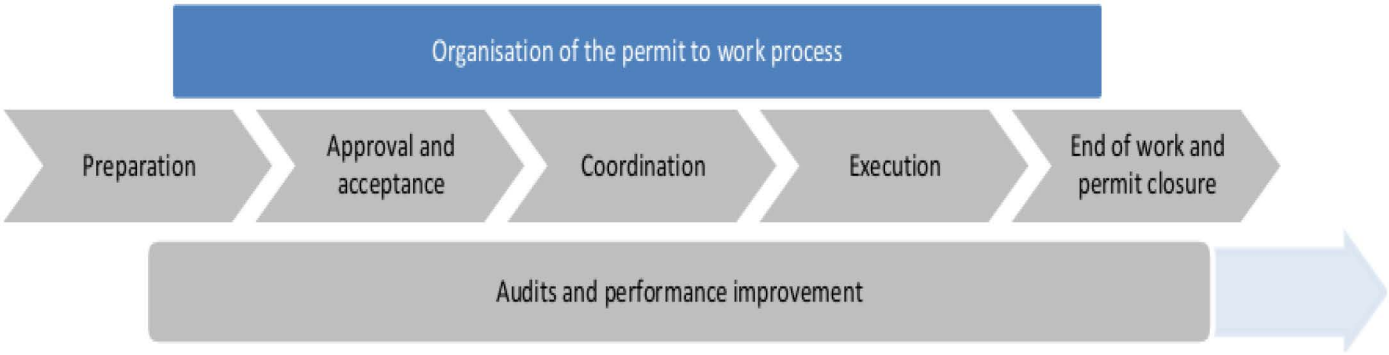

Figure – 2.0—Organization of the Permit to Work Process

Management of Change

The project team maintain a process for planning and controlling changes, both permanent and temporary, in people, equipment and working procedures to avoid any damaging HSE consequences

The following list shows the stages for management of change:

- Identification of need for a change
- Evaluation of potential consequences (positive and negative)
- Approval at a level appropriate for the risk.
- Implementation including communications at all potentially impacted parties.
- Closeout to ensure completion of the change and to capture lessons learned.

The fundamental concept of this MOC process is that recommended changes are evaluated; risks involved are identified and reviewed at levels commensurate with the risk. Also, specific measures to prevent or mitigate the potential risks are taken prior to making the change, and appropriate documentation is completed prior to closeout

Project HSE performances and Reporting

On weekly and monthly basics an HSE performance and reporting provide statistics, in accordance with the Project HSE plan and procedure on:

Number of 'lagging' indicators for each of the following during the reporting period:

- Fatalities
- Loss Time Incidents (LTI)
- Days lost due to LTIs o Restricted workday cases
- Medical treatment cases
- First-aid cases
- Near-miss incidents
- Incidents with high potential severity
- Material damage (>$20,000)

- Damage to the environment (including accidental discharges)

Number of ‘field indicators ‘measuring current status:

- Anomalies
- Safety actions identified during a site visit
- Pending Priority 1 actions
- Downgraded situations
- Campaigns on high-risk activities
- Risk management assessments performed (e.g., JRA's)
- Number of ‘leading ‘indicators (pro-active measures) taking into account actual versus planned:
- Number of both HSE and Steering Committee meetings held
- HSE training man-hours
- Number of HSE Inductions
- Work preparation and work permit activities together with Number of risk assessments and JRA
- HSE equipment inspections
- HSE audits and inspections completed versus planned
- Audit action completion rate (%)
- HSE site tours o Number of Emergency drills performed o Toolbox talks
- Man-hours worked in the reporting period
- Severity Rate (days lost per LTI)
- Loss Time Injury Frequency (LTIF) for the year to-date / 12 months rolling
- Anomalies per million man-hours to-date
- The Total Recordable Injury rate (TRIR) for the year to-date, per million man-hours to date
- High Potential Incident Frequency (HPIF)
- Any other HSE events of interest during the reporting period

Audit / Inspection plan

Safety Audit/inspection plan is developed. Audit covers both contractors yard and project sites. The audit tool is to enhance safety performance in project sites and base operations. All reports from HSE site audit are submitted to the project manager after the audit. Audits reports are communicated to top management, corrective actions are implemented and reviewed. HSE audits findings and actions are follow up and tracked in a database for closure.

HSE Inspection

Planned inspection by line management of work sites will be conducted to confirm the effectiveness of project site HSE plan. All reports from HSE site audit/inspections shall be submitted to the project manager after the audit/inspection. Relevant actions identified during these inspections are recorded and sufficient

time is provided to close out. Inspections to be conducted and frequency are weekly, biweekly, bimonthly, twice monthly, quarterly, yearly, etc.

Learning from Events

All events and incidents are investigated. An incident investigation is done as soon as possible, but no later than 24 hrs from the occurrence of the incident.

Objectives of the Investigation are:

- To establish Root or underlying cause (s) of the accident/incident, which are defined as management system (s) failure(s) that led to unsafe act / condition.
- To find all other causal factors (negative/unwanted event that led directly to the incident)
- To provide recommendations to determine effective corrective actions aimed at preventing other similar types of incidents
- To provide key learning (information useful to other sites)
- Disseminate the learning points

These Return on Experience of an event are shared during Project HSE site committee meetings, safety stand-down, site toolbox talks, etc.

HSE Performance

The positive results from TEPNG management commitment to health and safety enhances continuous improvement in health and safety and the subsequent reduction in accident and occupational ill health rates that lead to NO manhours.

TEPNG is committed to continuous improvement of its safety culture and recognize the importance of working closely with our personnel and Subcontractors, only through close cooperative effort of all can the best Health, Safety and Environmental record be achieved.

HSE performance are improved through the following.

- HSE performance compared to objectives,
- Corrective actions "to do" and "done" as defined by the following categories of HSE evaluations: risk assessments, drills, reviews, incidents and near misses' analysis, audits, inspections and environmental monitoring,
- HSE training
- HSE meetings
- Modification of safety procedures,
- Renewal of worn out or damaged safety equipment,
- Consumable gas storage, segregation, handling and use
- Inspection of cranes and other lifting appliances,
- Implementation of colour code system for lifting slings and apparatus,
- Up-grading of waste management system

Project HSE Awareness Campaign

Perfect Day

Here, a set of #5 indicators were defined for the project before to declare each day as a perfect day upon the fulfillment of the perfect day requirement and indicators. A Perfect Day is a day when there is no injury, no incident no significant environmental impact and all leading indicators set by the project are achieved throughout the duration of a full workday.

This has contributed to keeping the project workforce committed and motivated in ensuring each day ends safely for human, asset and materials.

Zero Fatality Program

- **Safety Green Lights:** Establish as part of the PTW pre job checks to be done focused on the prevention of accidents
- **Joint Safety Tours:** This involves company and contractor management visiting project site from time to time. A report from the safety tour team is issued and all deviations, corrective and recommendations actions are factored into the HSE performances review meetings for continuous monitoring and Improvement.
- **Life Saving Checks:** Focuses on strengthen and increase on-site checks to measure compliance to our HSE rules with a view to strengthening fatal accident prevention
- **Communication Effort:** To increase awareness and communication on life threatening issues at the project site

Stop Card: This is an authority given fron the top management to all personnel, mandating the Use of a Stop card to intervene in an unsafe act and unsafe situation at site

Performance Improvement

The Project Management established an HSE action plan for continuous improvement in HSE performance. In order to improve performance, HSE action plans was systematically reviewed at key stages of the Project to ensure that they are appropriate to the phases of Project activities. These reviews took into account audit and inspection results, risk analysis and feedback from relevant incidents and anomalies reports

Based upon these reviews, Project Management ensured that the Project HSE Plan and operational procedures are updated in line with the findings. In addition, HSE Committees were required for all Packages and included Nigerian construction sites where performance improvement was monitored.

HSE Committee meetings were held both in Project Management Team and Packages (offices and construction yards), these meetings had served as forums for feedback on HSE performance to personnel and contractors.

On completion of the Project, the Management consolidated all feedback and experiences to the Corporate HSE Group for referencing.

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Conclusion

Following the robust implementation of HSE project management system for Ikike project backed with management commitment to Zero fatality operations. This project was safely executed and commissioned with over 6Million+ No Lost Time Incident manhours.

Acknowledgements

The authors acknowledge the contributions of reviewers/assurers who brought clarity to the work and paper. Special appreciation to TotalEnergies for the permission to present and publish this paper.

Nomenclature:

LTI	Lost Time Incident
LTIF	Loss Time Injury Frequency
HPIF	High Potential Incident Frequency
TRIR	Total Recordable Injury rate
JRA	Job Risk Assessment
MOC	Management of Change
LOTO	Lock out Tag out
SIMOPS	Simultaneous Operations
ALARP	As Low As Reasonably Practicable
IKD1	Ikike Drilling Platform 1
TEPNG	TotalEnergies Nigeria

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